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REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND THE LATE

CAPTAIN FRANK TOURLE THOMSON, R.N.

PREPARED UNDER THE SUPERINTENDENCE OF

THE LATE

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DIRECTOR OF THE CIVILIAN SCIENTIFIC STAFF ON BOARD

AND NOW OF

JOHN MURRAY

ONE OF THE NATURALISTS OF THE EXPEDITION

ZOOLOGY—VOL. XIII.

PART XXXVI.—REPORT ON THE GEPHYREA.

BY PROFESSOR EMIL SELENKA.

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EDITORIAL NOTE.

THE description of the Gephyrea collected by the Expedition was originally undertaken by Professor E. Ray Lankester, F.R.S., but after the publication of Professor Selenka's splendid systematic Monograph on the group, Professor Lankester suggested that it would be much better if an arrangement could be made by which Professor Selenka should take over the examination of the Challenger collection. Professor Selenka complied with a request to do so, and this Part gives the result of his labours.

The Manuscript was received by me on the 12th March 1885, and was translated from the German by J. Arthur Thomson, Esq., M.A.

JOHN MURRAY.

CHALLENGER OFFICE, 32 QUEEN STREET,
EDINBURGH, 1*st October* 1885.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the GEPHYREA collected by H.M.S. Challenger during the Years 1873–76. By Dr. EMIL SELENKA, Professor in the University of Erlangen.

INTRODUCTION.

AMONG the Gephyrea collected during the Challenger Expedition, many different genera are represented, but the number of species is comparatively small. The twenty-eight species to be afterwards discussed are distributed over eleven genera, and these already known. Two of these genera were indeed described as new by the late R. von Willemoes-Suhm in his letters published in the Zeitschrift für wissenschaftliche Zoologie and in his manuscript notes. But an examination of the original specimens has shown that one of these is really a *Bonellia*, and the other, designated *Leioderma*, n. gen., by v. Willemoes-Suhm, a true *Phymosoma*. The latter species, along with some other more or less damaged specimens, must, moreover, be excluded from our description, since their state of preservation was not such as to admit of an accurate diagnosis of their specific characters. None of them, however, exhibited any important peculiarities.

The habitat and distribution of some of the species are of special interest. Some forms which had previously been found only near the shore, were on the Challenger Expedition dredged from very considerable depths. One new deep-sea species was found in the Pacific and also in the North Atlantic Ocean, and in regard to other forms the range of distribution was shown to be much wider than had hitherto been recognised.

If one may venture to draw general conclusions from the scanty material at our disposal, it appears probable that the tube-inhabiting Gephyrea (genus *Phascolion* and many species of *Phascolosoma*) occur especially in the greater depths, where as yet there has been found only a single example of the free-living forms of the genus *Phymosoma*.

This difference in the distribution of these allied genera seems to be associated with differences in temperature. The eighteen known species of *Phymosoma* are almost exclusively tropical or subtropical forms,[1] occurring only at moderate depths or near shore, and therefore in water comparatively warm. Now, since the temperature of the deep sea is on the whole strikingly low, the almost total absence of forms of *Phymosoma* in these depths may be conditioned by the lack of the requisite warmth. On the other hand, the great majority of the tube-inhabiting forms belonging to the genera *Phascolosoma* and *Phascolion* were found in the waters of the temperate and cold zones, and in the deep sea, while several species of the same genera are also tropical.

In describing the various species I have given references to the more important literature of the subject. In regard especially to the *Gephyrea achæta*, I would mention my recent monograph on the *Sipunculi*.[2]

Synopsis of the Genera and Species.

A. Gephyrea chætifera.

Genus 1. *Sternaspis*, Otto.

1. *Sternaspis princeps*, n. sp.

Genus 2. *Echiurus*, Guérin.

2. *Echiurus unicinctus*, v. Drasche.

Genus 3. *Thalassema*, Gaertner.

3. *Thalassema faex*, n. sp.
4. *Thalassema baronii*, Greeff.

Genus 4. *Bonellia*, Rolando.

5. *Bonellia suhmii*, n. sp.

B. Gephyrea achæta.

Genus 5. *Phascolosoma*, F. S. Leuckart (*s. str.* Selenka and de Man).

(*a*) Proboscis with four retractors. Hooks present.

6. *Phascolosoma vulgare*, de Blainville.
7. *Phascolosoma vulgare*, var. *astuta*, nov.
8. *Phascolosoma pudicum*, n. sp.

[1] We have an exception in the *Phymosoma granulatum* of the Mediterranean, which is most closely allied to the *Phymosoma scolops* of the Red Sea and Pacific and Indian Oceans, and which has doubtless found its way from the Red Sea into the Mediterranean.

[2] Die Sipunculiden, eine systematische Monographie, unter Mitwirkung von Dr. J. G. de Man and Dr. C. Bülow bearbeitet von Dr. Emil Selenka; in Semper's Reisen im Archipel der Philippinen, Theil. II. Bd. iv. Abth. 1, also separately, Wiesbaden, 1883.

(*b*) Proboscis with four retractors. Hooks absent.

9. *Phascolosoma capense*, Teuscher.

(*c*) Proboscis with two retractors. Hooks absent.

10. *Phascolosoma prioki*, Sluiter.
11. *Phascolosoma catharinæ*, Fritz Müller.
12. *Phascolosoma flagriferum*, n. sp.

Genus 6. *Dendrostoma*, Grube.

13. *Dendrostoma blandum*, Selenka and de Man.

Genus 7. *Phascolion*, Théel (Selenka and de Man).

14. *Phascolion squamatum*, Koren and Danielssen.
15. *Phascolion lutense*, n. sp.
16. *Phascolion tubicola*, Verrill.
17. *Phascolion botulus*, n. sp.
18. *Phascolion strombi* (Montagu).

Genus 8. *Aspidosiphon*, Grube.

19. *Aspidosiphon speculator*, n. sp.
20. *Aspidosiphon truncatus*, Keferstein.

Genus 9. *Phymosoma*, Quatrefages (Selenka and de Man).

21. *Phymosoma japonicum*, Grube.
22. *Phymosoma scolops*, Selenka and de Man.

Genus 10. *Sipunculus*, Linné.

23. *Sipunculus nudus*, Linné.

C. Appendix.

Genus 11. *Chætoderma*, Lovén.

24. *Chætoderma militare*, n. sp.

DESCRIPTION OF GENERA AND SPECIES.

Order GEPHYREA.

Annelids with degenerated segmentation, without external jointing, without parapodia, and without dorsal gills. There is a closed vascular system, and one to three (rarely six) pairs of segmental organs. There are seldom numerous setæ, and in most species none. The sexes are separate. Found in all seas.

A. Gephyrea chætifera.

Gephyrea with setæ.

Genus 1. *Sternaspis*, Otto.

The body is indistinctly segmented, and there are bundles of setæ both anteriorly and posteriorly. The ventral surface is smooth, and at the posterior end there is a shield, the borders of which are provided with setæ. The anterior end of the body bears a long forked proboscis. Anus at the posterior end, and beside it numerous retractile gill-filaments (Kiemenfäden). Found in all seas.

Since Sluiter found a long forked proboscis in the East Indian *Sternaspis spinosa*, Sluiter, we are probably justified in assuming the presence of a similar proboscis in the other species of the genus, although it has as yet been observed only in that one. Sluiter himself reports, indeed, that the proboscis is always thrown off by the animal a few minutes after its capture.

It does not seem to be beyond question whether the form preserved in the Challenger collection can be regarded as really the representative of a distinct species. All the species of *Sternaspis* as yet known are very like one another, and our *Sternaspis princeps* is only distinguished by subordinate characters, on the one hand from *Sternaspis spinosa*, Sluiter, from Batavia, and on the other from the *Sternaspis costata* of Marenzeller, from the Bay of Miya. The imperfect preservation of the Challenger specimen unfortunately does not admit of any intimate description of the anatomical structure.

1. *Sternaspis princeps*, n. sp. (Pl. I. fig. 1).

Along the middle of the ventral surface there runs a shallow furrow, and each half is divided by a diagonal keel into an anterior larger and a posterior smaller triangle. There are forty tufts of setæ on the margin of the shield. The whole body is studded with fine scattered chitinous setæ, each having at its base a number of smaller chitinous pieces grouped together into a small wart-like protuberance.

Of the two specimens preserved the larger is represented in fig. 1.

Habitat.—Station 169, July 10, 1874; lat. 37° 34′ S., long. 179° 22′ E.; depth, 700 fathoms; bottom temperature, 40°·0; blue mud; trawled.

Genus 2. *Echiurus*, Guérin.

The proboscis has a deep furrow, but is not split in front. There are two anterior ventral hooked setæ, and one or two circles of posterior bristles. Two pairs of segmental organs, two internal anal vesicles (Analkiemen) with ciliated funnels.

2. *Echiurus unicinctus*, von Drasche (Pl. I. fig. 2; Pl. III. figs. 11, 12).

> *Echiurus unicinctus*, von Drasche, Ueber eine neue *Echiurus*-Art aus Japan, &c., Verhandl. d. k. k. zool.-bot. Gesellsch. Wien, Bd. xxx. pp. 621–628, Taf. xxx. fig. 1, Jahrg. 1880, 1881.

Short proboscis. There is only one circle of posterior bristles. The paired appendages of the segmental organs are long and spirally coiled.

Out of twenty-one specimens the average length was 7 cm. and the breadth about 15 mm. The largest was $9\frac{1}{2}$ cm. long. All were much contracted. The grooved proboscis is not very sharply distinguished from the body, it has a conical form and is very short, not exceeding 6 mm. in its contracted state. The papillæ on the skin measure from 0·2 to 0·5 mm., and look like numerous little knots. They are not arranged in transverse rows except at special places, as for example close beside the ventral setæ. The preserved specimens are of a bright yellowish-brown colour. Immediately behind the base of the proboscis on either side of the median ventral line are the two moderately strong hooked setæ. At the posterior end of the body there is an anal region bordered by a single circle of golden stylet-like setæ, bent slightly outwards. In most of the specimens there were eleven of these setæ, but in some nine, ten, twelve, or thirteen. As in the other species of *Echiurus*, the circle of setæ exhibited a distinct gap on the ventral surface. Here and there reserve setæ may be seen. In regard to the musculature, it may be noted that the internal layer of circular muscles consists of about

two hundred bands repeatedly anastomosing. The alimentary canal consists of a pharynx, a narrow muscular œsophagus, an intestine with three main loops, which after forming a small cæcum is continued into a wide rectum terminating in the cloaca. Each loop of the intestine is attached to the body-wall by special muscles, which frequently broaden out into a fan-shape as they approach the intestine. The strands attaching the rectum ("Befestiger") are especially numerous (sixty to seventy). As regards the vascular system, two vessels admit of ready recognition, one dorsal accompanying the alimentary canal, and one ventral lying above the nerve-cord. Like v. Drasche I was unable to discover any trace of a vascular ring. Both pairs of segmental organs have associated with them near their external opening two spirally coiled appendages like those which occur in most species of *Thalassema*, where Greeff has described them under the designation "spiral tubes." They are also described and figured by v. Drasche. The anal vesicles are in structure like those of *Echiurus pallasii*.

Some of the specimens were so well preserved that a detailed representation of the ciliated funnels was in some cases possible (Pl. III. figs. 11, 12).

Habitat.—Inland Sea, Japan. From fishermen, May 28, 1875.

Von Drasche notes that in both the specimens which he examined the proboscis (Kopflappen) was wanting. Careful investigation, however, has convinced me that the short process at the anterior end of the body really represents the *whole* proboscis. It is quite likely then that even in von Drasche's specimens the proboscis was present and complete.

This species was first mentioned by Willemoes-Suhm[1] in the following terms:—"A new Echiurid from the Japanese coast, used by the fishermen as bait, and occurring in the mud close by the shore. The worm measured 3 to 4 inches in length, and in all its characters resembled the genus *Echiurus* except in having a single posterior circle of setæ instead of two."

Genus 3. *Thalassema*, Gaertner.

Body swollen with a short undivided proboscis. Two internal anal vesicles, usually with ciliated funnels. Only two anterior ventral hooked setæ. There are one to six pairs of (anterior) segmental organs.

3. *Thalassema faex*, n. sp. (Pl. III. fig. 13).

The longitudinal musculature is undivided. There is only a single pair of segmental organs. The proboscis is small. The thin skin of the preserved specimen is whitish and smooth, the papillæ are indistinct and scattered. The intestine exhibits the usual charac-

[1] Brief VII. an C. Th. von Siebold, *Zeitschr. f. wiss. Zool.*, Bd. xxvii. p. cii., 1876.

teristics. The anal vesicles are of moderate size, with irregularly distributed cæcal appendages, some of which are simple and others much branched, and which seem usually to bear at their apex only a single minute ciliated funnel. In front of the external openings of the segmental organs are two small hooked setæ. There is only a single pair of segmental organs, which have at their extremity a folded and wrinkled vesicle.

There was only a single contracted specimen about 40 mm. long and 15 mm. broad.

Habitat.—H.M.S. "Porcupine," Station 77, 1869; lat. 60° 34′ N., long. 4° 40′ E.; 560 fathoms.

In some other species, namely in *Thalassema möbii*, Greeff,[1] and *Thalassema vegrande*, Lampert,[2] the longitudinal musculature consists, as in this case, not of a number of separate strands, but of a continuous sheath. These two species above mentioned, however, possess three pairs of segmental organs, and are therefore readily distinguishable from *Thalassema faex*. A single pair of segmental organs is characteristic only of the latter and of *Thalassema gigas*, Max Müller, which was found at Trieste, and is not identical with this species.

4. *Thalassema baronii*, Greeff.

Thalassema baronii, Greeff, Die Echiuren (Gephyrea armata), Nova Acta Acad. Caes. Leop.-Carol., Bd. xli. pars ii., No. 1, pp. 151, 152, Taf. vi. figs. 63, 64, 1880.

Owing to the imperfect preservation of the single specimen, only a very incomplete examination of the internal organs was possible. The proboscis was torn away. Greeff found the species at Arrecife on the Canary Island Lanzerote, near the shore, among lava blocks and débris. Of the real colour of *Thalassema baronii*, which Greeff describes as dark green with longitudinal stripes of violet, there was no longer any trace in the yellowish-brown specimen of the Challenger Expedition. On the other hand, however, the two forms, found in such different places, agree in the following characters.

The whole body is covered with small papillæ. Each of the two pairs of segmental organs has at its extremity a funnel. The anal vesicles have the form of two long tubes, bearing on their surface short tree-like branches, which to the naked eye look like tufts, and which possess terminal ciliated funnels. The longitudinal musculature of the body-wall is arranged in from twenty to twenty-three strands.

Habitat.—Bahia, September 1873, 7 to 20 fathoms.

The anatomical structure of the Challenger specimen so closely resembles that of Greeff's species that I have no hesitation in identifying the two forms.

[1] R. Greeff, Die Echiuren (Gephyrea armata), *Nova Acta Acad. Caes. Leop.-Carol.*, Bd. xli. pars ii., No. 1, p. 152, 1880.

[2] K. Lampert, Ueber einige neue Thalassemen, *Zeitschr. f. wiss. Zool.*, Bd. xxxix. p. 341.

Genus 4. *Bonellia*, Rolando.

Body swollen. Proboscis much elongated and forked at the apex. There are only two anterior hooked setæ. Two internal anal vesicles with ciliated funnels; only a single anterior segmental organ (the uterus). The male is Planarian-like, without mouth or anus.

5. *Bonellia suhmii*, n. sp. (Pl. I. fig. 3; Pl. II. figs. 4–6).

In fig. 3 is reproduced the original sketch of Willemoes-Suhm. His manuscript notes on the internal structure of this form are not quite correct. He erred by mistaking mouth for anus, and *vice versa*.

Anatomical investigation has demonstrated that this form, which was described in v. Willemoes-Suhm's notes as a new genus, is really a true *Bonellia*. It must be confessed that both the posterior end of the body and the proboscis were torn away from the specimen, that the hooked setæ were not to be found, that the intestine was only partially present, and, in general, that the internal organs were much injured and torn. Yet from the following description it will be seen that we have here undoubtedly to do with a true *Bonellia*.

Fig. 3 on Pl. I. displays the single specimen in its natural size. The dermal muscular sheath was for the most part relaxed anteriorly, and much contracted posteriorly. Over this posterior portion the external skin seemed to be covered by irregularly distributed warts. Of the internal organs the following were preserved (Pl. II. fig. 4): —the anterior portion of the alimentary canal (torn away at *y*), the œsophageal nerve-ring and ventral cord (*n*), the uterus (*u*), with its ciliated funnel, and the two anal vesicles (Σ, Σ), of which the anterior portion is slightly enlarged in fig. 6.

The uterus (fig. 5) was filled with about sixty eggs, which exhibited the characteristic structure of the ripe eggs of the Mediterranean *Bonellia*. The male was not to be seen either in the œsophagus or in the uterus.

Habitat.—Station 47, May 7, 1873; lat. 41° 14′ N., long. 65° 45′ W.; depth, 1340 fathoms, off Nova Scotia; blue mud; dredged.

I have taken this opportunity of giving a figure of the male *Bonellia viridis*, Rolando, more complete than hitherto (see Pl. II. figs. 7–10).

The males of *Bonellia* were, as is well known, first described by A. Kowalevsky[1] as Planarian-like parasites in the uterine portion of the female genital duct.

The discovery of the Russian embryologist was confirmed by Catta and Marion,[2] and

[1] A. Kowalevsky, *Schriften d. naturf. Gesellsch. zu Kiew*, Bd. v., and also in a French translation under the title Du mâle planariforme de la Bonéllie, *Revue des Sci. Nat.*, t. iv., No. 8, pp. 313–319, pl. vii., 1875.

[2] *Ibid.*

the latter noted on the minute male the presence of two hooks behind the mouth opening. Vejdovsky[1] investigated anew the structure of the male *Bonellia*, and discovered the central nerve-cord, which had till then been overlooked. I then[2] described for the first time the œsophageal nerve-ring, the alimentary canal without mouth or anus, and the two rudiments of the anal vesicles. In a very exhaustive memoir Spengel[3] has given figures and description of the structure of the male *Bonellia*, yet both this naturalist and Greeff have overlooked the rudimentary anal vesicles which I have here figured in Pl. II. fig. 10. After Spengel's excellent description it seems to me unnecessary to enter further into the discussion of the anatomical details, and I therefore simply refer to the figures.

B. Gephyrea achæta.

A. *Gephyrea without setæ.*

Genus 5. *Phascolosoma*, F. S. Leuckart.

The longitudinal musculature is continuous and not divided into distinct bands. There are numerous tentacles arranged in a circle or in groups round about the mouth. The intestine is spirally coiled. The "intestinal spiral" (Darmspira) in the posterior portion of the body quite unattached. Hooks may be absent. There are two free segmental organs. Eggs spherical. Two to four retractors of the proboscis. Found in all seas.

6. *Phascolosoma vulgare*,[4] de Blainville.

Sipunculus vulgaris, de Blainville, Dict. d. Sci. Nat., t. xlix., 1827, pp. 312, 313, Vers., pl. xxxiii. fig. 3.

Syrinx harveyi, Forbes, A History of British Starfishes, London, 1841, p. 249, with woodcut.

Phascolosoma vulgare, Keferstein, Beiträge zur Kenntniss der Gattung Phascolosoma, F. S. Leuckart, Zeitschr. f. wiss. Zool., Bd. xii. p. 39, Taf. iii. fig. 3, 1862; *Ibid.*, Bd. xv. p. 429, Taf. xxxi. fig. 5, 1865.

Phascolosoma margaritaceum, Keferstein, Beiträge zur anatomischen und systematischen Kenntniss der Sipunculiden, Zeitschr. f. wiss. Zool., Bd. xv. p. 530, Taf. xxxi. fig. 9, Taf. xxxii. figs. 28, 29, 1865.

[1] F. Vejdovsky, Ueber die Eibildung und Männchen von Bonellia viridis, Rol., *Zeitschr. f. wiss. Zool.*, Bd. xxx. pp. 487–500, pl. xxx., 1878.

[2] Em. Selenka, Das Männchen d. Bonellia, *Zool. Anzeiger*, No. 6, p. 120, 1878.

[3] G. W. Spengel, Beiträge zur Kenntniss der Gephyreen, I. Die Eibildung, die Entwickelung und das Männchen der Bonellia, *Mitteilungen aus der Zoolog. Station zu Neapel*, Bd. i. Heft. iii. Taf. viii.–xii., 1879.

[4] Strictly speaking the setæ are not always absent. In the young larva of *Phascolosoma vulgare*, for instance; I found three pairs of setæ. These are, however, subsequently thrown off. In the adult animals true setæ seem to be entirely absent. *Vide* Eifurchung und Larvenbildung von Phascolosoma elongatum, *Zeitschr. f. wiss. Zool.*, Bd. xxv. p. 446, Taf. xxx. figs. 14, 15, 18, 1875.

Sipunculus obscurus, Quatrefages, Histoire naturelle des Annelés marins et d'eau douce, t. ii. p. 216, pl. xvi. figs. 16, 17, 1865.

Phascolosoma validum, Théel, Etudes sur les Gephyriens inermes des mers de la Scandinavie, du Spitzberg et du Groenland, Bihang til k. Svenska Vet. Akad. Handl., Bd. iii., No. 6, Stockholm, pp. 7, 8, pl. i. fig. 5, pl. iii. fig. 18, pl. iv. fig. 20, 1875.

Phascolosoma luteum, Théel, *Ibid.*, p. 5, pl. ii. fig. 7, pl. iii. fig. 17.

Phascolosoma harveyi, Koren and Danielssen, Fauna littoralis Norvegiæ, Heft. iii., Bergen, p. 136, Tab. xv. figs. 41, 42, 1877.

Phascolosoma vulgare, Selenka and de Man, Die Sipunculiden, &c. (*loc. cit.*), pp. 20–23, Taf. i. fig. 1, Taf. iii. figs. 25–34, 1883.

The body is nearly 100 mm. long, the slender proboscis measures about the same. The thin skin is smooth except at the posterior extremity and at the base of the proboscis where there are numerous cylindrical papillæ, measuring up to 0·13 mm. in height, and becoming gradually smaller towards the mouth. There are about thirty-six tentacles, which are heart-shaped in cross section. The hooks are scattered, of irregular shape, mostly somewhat bent, and about 0·15 mm. long. Three fixing intestinal muscles, inserted on the gullet, on one of the first coils, and on the rectum. The proboscis has four retractor muscles. Those which are ventral spring from the anterior portion of the median third of the body, while those which are dorsal arise between the former and the anus.

Habitat.—H.M.S. "Porcupine," Station 30, August 2, 1870; lat. 36° 15′ N., long. 6° 52′ W.; depth, 386 fathoms: and Station 90, 1869; lat. 59° 41′ N., long. 7° 34′ E.; depth, 458 fathoms. This latter form might be considered as a variety of the ordinary *Phascolosoma vulgare*. Hitherto this species has been found in the Mediterranean, on the west coast of Europe (St. Vaast la Hongue, St. Malo, Roscoff, Bergen, North Sea), on the English coast, and in the Red Sea.

7. *Phascolosoma vulgare*, var. *astuta*, nov.

This variety, above referred to, differs from the typical form in having the whole body studded with papillæ, and not merely the anterior and posterior portions.

8. *Phascolosoma pudicum*, n. sp. (Pl. III. figs. 14–16).

This species bears a most marked resemblance to the *Phascolosoma vulgare* of de Blainville, both in habit and in anatomical structure, but is distinguished both from it and from the *Phascolosoma vulgare astutum* by the following characters:—the hooks are not scattered, but are arranged in distinct rows, the papillæ cover the whole body including the proboscis, the tentacles are less numerous (I counted at most twenty).

Habitat.—(*a*) Kerguelen, January 21, 1874, Cape Maclear; 30 fathoms (three specimens).

(*b*) Kerguelen, Station 149H, January 29, 1874, Cumberland Bay; 127 fathoms (numerous specimens).

(*c*) Kerguelen, 10 to 100 fathoms (one specimen).

The largest specimen measured in its extended state 36 mm., including the proboscis.

B. *Four Retractor Muscles. No Hooks on the Proboscis.*[1]

9. *Phascolosoma capense*, Teuscher.

Phascolosoma capense, Teuscher, Notiz über Sipunculus und Phascolosoma, Jenaische Zeitschr. f. Naturwiss., Jena, Bd. viii. pp. 498, 499, Taf. xix. figs. 45, 12 and 14, 1884.

Phascolosoma capense, Selenka and de Man, Die Sipunculiden, &c. (*loc. cit.*), pp. 29, 30, Taf. iii. figs. 40–43, 1883.

Of this species a great number of specimens are preserved; they vary from 20 to 35 mm. in length, not including the proboscis.

The body is four to eight times as long as it is broad. The proboscis measures about three-quarters of the length of the body. The skin is firm and somewhat shining. Even with the unaided eye one can recognise the numerous dark papillæ, which attain a height of 0·1 mm., and cover both the body and the proboscis. The ventral retractors of the proboscis spring from the middle third of the body, while those which are dorsal are at some distance from these, and spring from the anterior third. On the œsophagus there lies a long contractile tube bearing villi. The twisted intestine has about twenty double coils, and there is only a short anterior spindle-shaped muscle. There are three fixing muscles for the intestine.

Habitat.—Sea Point, near Cape Town; shallow water. November 1873.

C. *Two Retractors. No Hooks on the Proboscis.*

10. *Phascolosoma prioki*, Sluiter.

Phascolosoma prioki, Sluiter, Beiträge zur Kenntniss der Gephyreen aus dem Malayischen Archipel, Natuurkundig Tijdschrift van Nederlandsch Indie, Bd. xli. p. 152, Taf. i. figs. 5–9, Batavia, 1881.

Skin thin and smooth, without papillæ. The body is rather long and narrow, and the proboscis is longer than the body. The two retractors of the proboscis have their origin far back in the body. The spindle-shaped muscle is but slightly developed, but there are numerous muscles fixing the intestine.

[1] The presence or absence of these proboscal hooks is a distinctive character for most of the species of the genera—*Phascolosoma*, *Phymosoma*, and *Phascolion*. But since the hooks sometimes fall off entirely, too much stress must not be laid upon this specific difference. In no case, however, is the presence or absence of hooks on the proboscis a distinction between genera.

On anatomical examination the minute specimen (13 mm.) of the Challenger Expedition was seen to be identical with the *Phascolosoma prioki* of Sluiter.

Habitat.—Station 214, on February 10, 1875; lat. 4° 33′ N., long. 127° 6′ E.; depth, 500 fathoms; bottom temperature, 41°·8; blue mud; dredged.

Sluiter obtained his specimens from *Dentalium* shells at Tandjong Priok, Batavia. In regard to the specimen above referred to, there is no note as to whether it also was obtained from a Mollusc shell.

11. *Phascolosoma catharinæ*, Fritz Müller.

Phascolosoma catharinæ, Fritz Müller; Grube, Notiz über Loxosiphon, Cloeosiphon und einige Phascolosomen, Jahresbericht der Schles. Gesellsch. für vaterl. Cultur, Jahr 1867, p. 48, Breslau, 1868.

Phascolosoma catharinæ, Selenka and de Man, Die Sipunculiden, &c. (*loc. cit.*), pp. 15, 16, Taf. ii. fig. 16, Taf. v. figs. 60–63, 1883.

The body is long and narrow, with a slender proboscis four times as long as the body. The skin is thin and iridescent. Only with the aid of a lens can one recognise the minute papillæ which cover the whole body. These papillæ are thinly scattered and have a conical form. At the posterior end of the body they measure 0·066 mm. in height and half as much in breadth, at the middle of the body they are somewhat smaller, and at the base of the proboscis somewhat larger again (up to 0·09 mm. in height). There are two slender ventral retractors, which originate in the posterior fourth part of the body, and which do not unite till far forward in the proboscis. The contractile tube is studded with short villi. The coils of the intestine are not numerous. There are two fixing muscles on the anterior coils. The two free segmental organs open a short distance in front of the anus.

Habitat.—Station 323, February 28, 1876; lat. 35° 39′ S., long. 50° 47′ W.; depth, 1900 fathoms; bottom temperature, 33°·1; blue mud; trawled. Of this there is only a single specimen.

Since Fritz Müller's specimen was labelled "Desterro," one may infer that it was not obtained in trawling, but was found on the shore during ebb tide. The specimen of the Challenger Expedition, on the other hand, was obtained from a very considerable depth. This difference of distribution is not, however, by any means unique, for other true Sipunculids exhibit a similar occurrence on the shore and at considerable depths.

12. *Phascolosoma flagriferum*, n. sp. (Pl. III. fig. 17).

Body and proboscis studded with very small papillæ, hardly visible with a lens. The posterior end of the body is furnished with wart-like papillæ measuring half a millimetre, and with a whip-like appendage. The coils of the intestine are very numerous.

The largest of the three specimens of this form measured with outstretched proboscis was 130 mm. in length, and had a breadth of about 13 mm.

The two retractors of the proboscis spring from about the middle of the body; after a short course they run together. The looped intestine has seventy coils or more, and is free posteriorly. In front, attached to the œsophagus, there is a long fixing muscle. There is also a spindle-shaped muscle. There are two segmental organs, entirely free, and opening beside the anus. Hooks are absent. Round about the mouth there is a circle of finger-like tentacles, heart-shaped in cross section. There is a simple contractile tube. The body-wall is rather thin but elastic.

In the Challenger collection there are two well-preserved specimens from the Pacific, and another single specimen from the east coast of North America. In spite of this very wide difference in distribution, a close comparison revealed no structural difference worth recording.

Habitat.—(*a*) Station 241, June 23, 1875; lat. 35° 41′ N., long. 157° 42′ E.; depth, 2300 fathoms; bottom temperature, 35°·1; red clay; trawled (two specimens).

(*b*) Station 44, May 2, 1873; lat. 37° 25′ N., long. 71° 40′ W.; depth, 1700 fathoms; bottom temperature, 36°·2; blue mud; dredged (one specimen).

Genus 6. *Dendrostoma*, Grube.

Longitudinal musculature continuous and not divided into separate bands. The tentacles are united into four to six bundles. There are two free segmental organs. intestine spirally coiled, the intestinal spiral free posteriorly. Hooks present except when they have fallen off. Short, compressed, tropical, shore forms.

13. *Dendrostoma blandum*, Selenka and de Man.

Dendrostoma blandum, Selenka and de Man, Die Sipunculiden, &c. (*loc. cit.*), pp. 85, 86, Taf. i. fig. 9, Taf. xi. figs. 159–162, 1873.

Body swollen. Proboscis rather short. Skin brownish, of moderate thickness. On the middle of the proboscis is a zone of numerous, scattered, pointed, black hooks, 0·4 mm. in height, and therefore distinctly noticeable even to the naked eye. The whole body is studded with small scattered papillæ with a circular base. The tentacles are arranged in five (to six) main bundles. There are two powerful ventral retractors of the proboscis which have their origin in the median third of the body. Two segmental organs completely free. The contractile tube is destitute of villi.

Habitat—Yokohama (Japan); depth, 5 to 25 fathoms. May 6, 1875.

The only specimen obtained was found in the same place as those which have been previously recorded, namely, on the coast of Japan. Dr. Hilgendorf found the animal at a depth of 4 fathoms.

Genus 7. *Phascolion*, Théel (Selenka and de Man).

The animals of this genus live in tubes or in shells of Molluscs. The longitudinal musculature is continuous and not divided up into distinct bands. The tentacles are small and finger-like, and are arranged in a circle round about the mouth. There is only a single, fixed segmental organ. The intestine has only a few coils, or it may be none at all, but there are always some large loops which are attached by the so-called fixing muscles. The hooks of the proboscis often fall off at an early stage. The proboscis has either one or two retractor muscles. The posterior half of the body frequently with attaching papillæ (Haftpapillen). They are found in all seas, but especially in the colder waters.

It seems extremely probable that the species of the genus *Phascolion* do not form a compact, closely related group, but that they have developed independently from various true *Phascolosomata*. One marked characteristic of the species of *Phascolion* is the disappearance of one of the two segmental organs. Noteworthy also is the shortening of the intestine, associated with the assumption of the looped instead of the spirally coiled form. Now since all the species of *Phascolion* live in Mollusc tubes, the change of habitat must have reacted on the anatomical structure; it may, for instance, have to do with the degeneration of one of the segmental organs, and it may be that the burden of the shell has brought about the early attachment of the intestine by means of the fixing muscles. The fact that in many species of *Phascolosoma*, which inhabit Mollusc shells or tubes, one of the segmental organs is often absent but the coiled intestine apparently not shortened, shows us how such a degeneration as that of the species of *Phascolion* has arisen. In the latter, as we have mentioned, the spirally coiled intestine is unwound into loose loops, and there are transitional states between the two conditions.

If the supposition be correct that the species of the genus *Phascolion* are connected with those of the genus *Phascolosoma* by diverse lines of origin, the genus *Phascolion* should be resolvable into several, since the system ought to be the expression of phylogenetic relationship or genetic history. But since it is not possible to recognise these genetic relationships, far less prove them, I therefore retain for the present the single genus *Phascolion*.

14. *Phascolion squamatum*, Koren and Danielssen (Pl. IV. figs. 18–19).

Phascolosoma squamatum, Koren and Danielssen, Fauna littoralis norvegiæ, Heft iii. pp. 130, 131, Tab. xiii. fig. 11, Tab. xiv. figs. 14, 15.

Phascolosoma squamatum, Selenka and de Man, Die Sipunculiden, &c. (*loc. cit.*), p. 40.

The body is four times as long as it is broad. The proboscis is two and a half times as long as the body. The skin is studded all over with large, flat, more or less protrusive scales. On the proboscis are fine papillæ, arranged in separate rows and at a distance from one another, but somewhat more closely set near the tentacles. The tentacles are

short and thread-like. There is only one retractor muscle, which has four very short roots inserted at the hind end of the body. The intestine exhibits five loose loops in the right half of the body, and then passes into the close spiral with sometimes twelve double coils. A thin contractile tube. Only one segmental organ, on the left side of the body. The body is not more than 11 mm. in length.

Habitat.—(*a*) H.M.S. "Porcupine," Station 6, 1870; lat. 48° 26′ N., long. 9° 44′ W.; 358 fathoms.
(*b*) H.M.S. "Porcupine," Station 47, 1869; lat. 59° 34′ N., long. 7° 18′ W.; 542 fathoms.
(*c*) H.M.S. "Porcupine," Station 36, 1869; lat. 48° 50′ N., long. 11° 9′ W.; 725 fathoms.
(*d*) H.M.S. "Triton," Station 10, August 24, 1882; lat. 59° 40′ N., long. 7° 21′ W.; 516 fathoms.

The intestine contained numerous *Globigerina* shells, besides sand and fine débris of mussel-shells and of the calcareous plates of Echinodermata.

This species occupies a position only just within the genus *Phascolion*, being indeed a sort of connecting link with the genus *Phascolosoma*. It may be ranked as a species of *Phascolion* on account of (1) the disappearance of one of the two segmental organs and the fixing of the remaining one by means of a mesentery, (2) the coalescence of the retractors of the proboscis and the shifting of their insertion to the hind end of the body, (3) the smaller size of the tentacles, (4) the larger size of the eggs, (5) the development of the ordinary dermal papillæ into attaching papillæ, (6) the partial unwinding of the intestinal spiral into loose coils. On the other hand, since the intestinal spiral may still have as many as twelve double coils, the species may be claimed, as Koren and Danielssen have done, for the genus *Phascolosoma*. On the whole, however, there seems more reason, as we have indicated, to refer the species to the genus *Phascolion*.

15. *Phascolion lutense*,[1] n. sp. (Pl. IV. figs. 22, 23).

The skin is thin and without attaching papillæ (Haftpapillen) on the posterior part of the body. The whole body and proboscis studded with numerous scattered skin glands. These protrude as slight tubercles, and are supported by chitinous borders, which appear circular or elliptical according to the state of contraction of the cutaneous muscles. The diameter of these glands measures about one-third of a millimetre, but in the region about the base of the proboscis and about the anus the diameter is reduced by one-half or even much more. On the proboscis and on the posterior extremity of the body the glands bear villous-like bodies round their opening (Hohlpapillen). These papillæ are about

[1] *Lutensis*, living in the mud.

0·08 mm. long by 0·025 mm. broad; on other parts of the body they are wholly absent. There is only one retractor to the proboscis. The intestinal spiral has about twenty-three coils. The animal makes tubes in the mud.

Two of the three specimens were examined. The length of the largest was 30 mm., with proboscis wholly retracted. The thin transparent skin of the body was not coloured, the zone round about the anus was light brown.

Hooks on the proboscis absent. The tentacles are short and small. As in the other species of *Phascolion*, the tentacles are few in number, at most sixteen. The single retractor of the proboscis originates just in front of the hind end of the body, and possesses several diverging roots. Far back in the body, where the œsophagus passes into the intestine, the latter is attached by one fixing muscle. There are, however, some other fixing muscles on the threefold loops of the intestine and on the rectum.

The single segmental organ is on the right side of the body. It lies close behind the anus, and is throughout its whole length bound by connective tissue bands to the inner body-wall.

This species is distinctly characterised by the large number of intestinal coils and by the nature of the skin glands.

Habitat.—The animals were found in two localities near one another.

(*a*) Station 157, March 3, 1874; lat. 53° 55′ S., long. 108° 35′ E.; depth, 1950 fathoms; Diatom ooze; bottom temperature, 32°·1; trawled. (Two specimens with thick mud tubes.)

(*b*) Station 156, February 26, 1874; lat. 62° 26′ S., long. 95° 44′ E.; depth, 1975 fathoms; Diatom ooze; trawled. (One specimen and several mud tubes.)

16. *Phascolion tubicola*, Verrill.

Phascolion tubicola, Verrill, Results of Recent Dredging Expeditions on the Coast of New England, Amer. Journ. Sci. and Arts, ser. 3, vol. v., 1873, p. 99 (note); see also Explorations of Casco Bay by the U.S. Fish Commission in 1873, Proc. Amer. Assoc. Adv. Sci., 22nd meeting, 1874, pp. 388, 389.

Phascolion tubicola, Selenka and de Man, Die Sipunculiden, &c., pp. 24, 25, Taf. vi. figs. 80–86.

Body extended. Proboscis longer than the body. The whole body is covered with papillæ, which are small on the anterior portion of the proboscis and on the posterior half of the body, but are larger in other regions. On the posterior third of the body, with the exception of a short strip at the very end, there is a zone of irregularly scattered, triangular, yellowish-red prickles, with their points directed forwards. The proboscis bears a few brownish, pointed, unbent hooks which measure 0·06 mm. in length. There is a circle of from ten to twenty tentacles round about the mouth. Two retractor muscles, a thin ventral one and a thicker stronger dorsal one, are inserted with broad roots near the hind end of the body, and are not united till they have run well forwards.

The intestine is in loops, and the intestinal spiral exhibits only two coils. The single short segmental organ opens far behind the anus.

According to Verrill's report, this abundant species is only found in deep water.

Habitat.—Station 49, May 20, 1873; lat. 43° 3′ N., long. 63° 39′ W.; depth, 85 fathoms; bottom temperature, 35°; gravel, stones; dredged.

17. *Phascolion botulus*, n. sp. (Pl. IV. fig. 20).

On the posterior third of the body there are scattered rounded-off attaching papillæ (Haftpapillen), measuring 0·3 mm. in their greatest breadth and about 0·12 to 0·18 mm. in height. Two retractor muscles, one very powerful and another weak. Found in *Dentalium* shells.

It is impossible for me to give any complete description of this species, since only one imperfectly preserved specimen, 30 mm. long, was available for examination. This animal lay within the shell of a *Dentalium*, wholly embedded in mud. The intestine was somewhat destroyed by maceration.

One of the above mentioned papillæ, found on the posterior third of the body, is represented in fig. 20. They are distinctly visible to the unaided eye, especially since their brown pigment stands in marked contrast to the thin colourless skin of the body.

No hooks were to be found. The proboscis was almost completely retracted, in the living animal it was probably longer than the body, measured from the hind end to the anus.

The tentacles are small and few in number. No exact enumeration was possible.

The root of the more powerful retractor of the proboscis was divided into five; both retractors originated just in front of the hind end of the body.

The intestine exhibits a threefold, ascending and descending, loop, and the spiral consists of only two or three coils. The single segmental organ is half the length of the body, and at its very end is bound by mesentery to the body-wall.

Habitat.—Station 195, October 3, 1874; lat. 4° 21′ S., long. 129° 7′ E.; depth, 1425 fathoms; bottom temperature, 38°; blue mud; trawled.

18. *Phascolion strombi*, (Montagu) (Pl. IV. fig. 21).

Sipunculus strombus, Montagu, Trans. Linn. Soc. Lond., vol. vii. pp. 74–76, 1804.
Sipunculus bernhardus, Forbes, A History of British Starfishes, London, 1841, pp. 251–253 (woodcut).
Sipunculus concharum, Danielssen, Nyt Magaz. f. Naturvidensk. Christiania, 1861, pp. 57, 58.
Phascolosoma strombi, Keferstein, Beiträge zur Anatomie und System. Kenntniss der Sipunculiden, Zeitschr. f. wiss. Zool., 1868, Bd. xv. pp. 430–432, Taf. xxxi. fig. 10, Taf. xxxiii. figs. 34–36.
Phascolosoma strombi, Selenka and de Man, Die Sipunculiden, &c. (*loc. cit.*), pp. 50–53.

From among the many descriptions of this species, those above given will be sufficient (see the Bibliography in Die Sipunculiden, Selenka, de Man, and Bülow, pp. 50, 53).

The body is from four to seven times as long as it is broad. The proboscis is as long as the body or still longer. The skin is thin and covered with small scattered papillæ. Behind the middle of the body there is a broad girdle of flat attaching papillæ, measuring 0·24 mm., and arranged sparingly after a quincuncial pattern. In front on the proboscis there are several rows of simple hooks, whose bases measure about 0·05 mm. The ventral retractor of the proboscis is united with the dorsal to form one muscle. The intestinal spiral is short, with only two to four coils. There is on the rectum a small diverticulum. The contractile tube is without cæca. The single segmental organ is fastened to the body-wall by numerous bands.

Habitat.—H.M.S. "Porcupine," Killibegs Harbour, Ireland, June 24, 1869.

Genus 8. *Aspidosiphon*, Grube.

At the anus and at the posterior end of the body there is a distinct shield. The proboscis is very long, and much thinner than the body. It is excentric, and originates ventrally from the anal shield. There are almost always hooks present, and these usually exhibit two forms. The longitudinal musculature may be either continuous or separated into bands. The tentacles, which are small and finger-shaped, are few in number. Found in all seas.

19. *Aspidosiphon speculator*, n. sp. (Pl. IV. figs. 24–27).

The anal shield is rough and granulated; the posterior shield is grooved in a radiate fashion (with about thirty peripheral grooves). The longitudinal musculature of the body-wall is divided up into bands.

In the three specimens preserved, the colour of the general body surface was yellowish-brown, that of the anal and caudal shield dark brown. The body of the largest animal measured 14 mm. in length. The proboscis was of equal length, but one may certainly suppose that it could be very much elongated, as is the case in all the other species of *Aspidosiphon*.

In the anterior third of the body there are about twenty-two bundles of longitudinal muscles, anastomosing in a complex manner. Through the other two-thirds of the body these run in the form of fine distinct bands. The two strong ventral retractors of the proboscis originate a short way in front of the caudal shield and run together about half way up the body.

In *Aspidosiphon speculator*, as in all species of *Aspidosiphon*, the tentacles are few and short.

The skin glands are supported by countless small plates of chitin, which form a ring

round the opening of each gland. These structures do not, however, form papillæ, but at most appear as flat tubercles when the body-wall is very powerfully contracted.

The whole proboscis is thickly studded with hooks of two forms. On the anterior half the hooks are flattened, with a strongly curved double point; they measure 0·032 mm. in height, and are arranged in distinct rings. On the posterior half of the proboscis the hooks are scattered and in the form of three-sided pyramids, with but slightly bent points. Over the whole proboscis are seen the openings of the ducts (0·017 mm. in length) of the cutaneous glands. On the anterior half of the proboscis these occur in rows between the rings of hooks, about one duct for every three to five hooks; on the posterior half of the proboscis they occur much more sparingly, and are scattered.

The anal and caudal shields are formed from numerous small polygonal or rounded chitinous plates, which are somewhat larger and thicker round the margins of the shields.

The intestine forms a spiral, and a small diverticulum is present. There are two very large segmental organs, which are for half their length attached by means of mesenteries.

St. Vincent (Cape Verde Islands); shallow water.

20. *Aspidosiphon truncatus*, Keferstein.

Aspidosiphon truncatus, Keferstein, Untersuchung über einige amerikanische Sipunculiden, Zeitschr. f. wiss. Zool.,¶1866, xvii. p. 50, Taf. vi. figs. 15–18.

Aspidosiphon truncatus, Selenka and Bülow, Die Sipunculiden, &c. (*loc. cit.*), pp. 118, 119, Taf. xiii. figs. 193–195.

The body is brown, the two grooved shields are of a darker colour. The grooves of the anal shield run from the ventral side to the margin, those of the caudal shield run in radiate fashion. There are numerous rings of very small bent hooks. The longitudinal musculature is divided into strands. The retractor of the proboscis has two roots which originate on the posterior shield. At the point where the intestinal spiral passes into the rectum there is a diverticulum in connection with the latter. Both segmental organs are for the most part attached by mesentery to the body-wall.

Of this species a large number of specimens from the Philippines have been preserved, and I find after examination that they do not in any way differ from those forms which Agassiz found off Panama, and Möbius off Mauritius. The range of distribution must therefore be very wide. It might indeed be possible on close comparison to establish between our forms and those investigated by Keferstein a difference great enough to be considered a specific distinction, but with the form from Mauritius the Philippine species is certainly identical.

The animals were on an average 17 mm. long, not including the proboscis.

Habitat.—Station 201, October 26, 1874; lat. 7° 3′ N., long. 121° 48′ E.; depth, 82 fathoms; stones and gravel; trawled.

Genus 9. *Phymosoma*, Quatrefages (Selenka and de Man).

Longitudinal musculature divided into bands. There are numerous tentacles arranged in a single row, not however around the mouth, but above it dorsally in three-fourths of a circle. The body is covered with papillæ. Hooks are almost always present. The intestine is coiled in a spiral fashion. The eggs are elliptical and flattened. The proboscis has four retractor muscles. There are two eye spots. The members of this genus are mostly of considerable size, and the majority are tropical forms.

21. *Phymosoma japonicum*, Grube.

Phymosoma japonicum, Grube, 54th Jahresbericht der Schlesischen Geselleschaft für vaterländische Cultur, Breslau, 1877, p. 73.

Phymosoma japonicum, Selenka and de Man, Die Sipunculiden, &c. (*loc. cit.*), pp. 76–78, Taf. ii. figs. 18, 19, Taf. x. figs. 145, 146.

The body is compressed. The proboscis is as long as the body. Even with the naked eye one can clearly recognise the reddish-brown papillæ on the greyish-brown body. They are largest and most abundant at the base of the proboscis and at the hinder end of the body. On the older specimens there may be thirty rings of hooks, and on the young forms as many as a hundred. These hooks are flattened, measuring 0·07 mm. in height and the same in breadth; they have a sharply bent point with a side tooth. There are not more than twenty-eight tentacles. There may be as many as thirty longitudinal muscle-bands, which repeatedly anastomose. The intestine exhibits ten to twelve double coils. The two segmental organs are fixed by mesenteries throughout half their length.

Habitat.—Port Jackson, shallow water. There were only two tolerably large specimens.

22. *Phymosoma scolops*, Selenka and de Man.

Phymosoma scolops, Selenka and de Man, Die Sipunculiden, &c. (*loc. cit.*), pp. 41, 42, Taf. ii. fig. 17, Taf. x. figs. 138–144.

A small species with slender body, and proboscis equal to the body in length. The skin is thin. The proboscis frequently exhibits brown cross stripes on the dorsal surface. The whole body is studded with small papillæ. The proboscis has about sixteen rings of hooks, which are bent and measure 0·07 mm. in height, and 0·074 mm. at the base. On the concave side of the bent point there is a lateral tooth. The tentacles number twelve or more. There are about twenty longitudinal muscles which rarely anastomose, but unite just in front of the anus to form a continuous sheath. The four retractors of the proboscis originate about the middle of the body. The broader ventral retractors

consist of five or six longitudinal muscles, the narrower dorsal of one or two, originating a short distance in front of the former. The contractile tube is simple. On the intestinal spiral there are only from twelve to fourteen double coils. The posterior fourth part of both segmental organs is free.

Habitat.—This species has a somewhat wide range of distribution. Specimens have been obtained from the Philippines, from Singapore, and from the Red Sea; and Peters found a variety off Mozambique.

The single small specimen of the Challenger Expedition was labelled Station 208, January 7, 1875; lat. 11° 37′ N., long. 123° 31′ E.; depth, 18 fathoms; blue mud; trawled.

In the manuscript left by the late von Willemoes-Suhm I find some sketches and notes of a Sipunculid, which he considered as representative of a new genus. It is, however, a true *Phymosoma*, and seems indeed to be closely related to *Phymosoma varians*. But since the single specimen is only imperfectly preserved, so that a satisfactory diagnosis is now impossible, and since, further, the form exhibits no characters of special interest, I content myself with this reference.

Genus 10. *Sipunculus*, Linné.

The longitudinal musculature is divided into seventeen to forty-one bands. The proboscis has four retractors. The body is destitute of papillæ. The tentacles always surround the mouth, and either form a lobed membrane or are finger-shaped. There are no hooks, except in *Sipunculus australis*. Most of the species are large. They are found in all seas.

23. *Sipunculus nudus*, Linné.

This species, named by Linné,[1] is thoroughly described in Die Sipunculiden (*loc. cit.*), pp. 92–95.

Habitat.—It has been found in the Mediterranean, on the west coast of France, in the North Sea, off the West Indies, Florida, and the Philippines. The two specimens preserved came from the Spanish coast and from the North Sea, and are labelled as follows:—

(*a*) H.M.S. "Porcupine," No. 30, August 2, 1870; lat. 36° 15′ N., long. 6° 52′ W.; depth, 386 fathoms.

(*b*) H.M.S. "Porcupine," No. 22, 1869; lat. 56° 8′ N., long. 13° 34′ W.; depth, 1263 fathoms.

[1] Systema Naturæ, Editio duodecima I. Holmiæ, 1766, p. 1078.

C. Appendix.

Among the worms entrusted to me for investigation there was a *Chætoderma* from the Malayan Archipelago. In spite of the investigations of Lovén, Keferstein, Möbius, Graff, and Arnauer Hansen, the systematic position of this animal remains a very debateable question. Nor am I able to contribute anything to the elucidation of the problem, for the single specimen at my disposal was too soft and too easily broken to admit of the investigation of its internal structure. Nor did the examination of a series of cross-sections yield me the desired information. This only I am able to affirm, that the specimen of the Challenger Expedition does not structurally differ in any essential point from the *Chætoderma nitidulum*, Lovén, from the North Sea. There were, however, noticeable differences in the form of the calcareous spicules, and on these I have been compelled to base the diagnosis of the species.

Genus 11. *Chætoderma*, Lovén.

Worm-like hermaphrodite animals without segmentation. A cerebral ganglion and paired lateral nerve-cords. The mouth bears teeth, and the whole body is studded with calcareous spicules.

24. *Chætoderma militare*, n. sp. (Pl. IV. figs. 28–32).

The calcareous spicules of the proboscis are in the neighbourhood of the mouth flat and elliptical, further back they are larger and have the form of shovel-like or tongue-like plates, and finally, they gradually become smaller again and take the form of keeled spear-like points. The body proper bears only a very few thinly scattered rounded calcareous plates, but at the posterior end there are again large plates, which towards the anus become long stout prickles with a cross-section between circular and elliptical. Round about the anus are numerous small prickle-like or awl-shaped calcareous needles.

Habitat.—Station 210, January 25, 1875; lat. 9° 26′ N., long. 123° 45′ E.; depth, 375 fathoms; bottom temperature 54°·1, surface temperature 80°·2; blue mud.

I regret that it is impossible for me to give a more accurate diagnosis of this species. The only species of *Chætoderma* as yet known, namely the *Chætoderma nitidulum*, Lovén, was found in the North Sea, and it would have been desirable to submit to a close comparison forms found in such different localities.

But since the nature of the calcareous spicules affords a ready distinctive character, I do not hesitate to establish the single example of the Challenger Expedition as a new

species. In *Chætoderma nitidulum*, Lovén, the calcareous needles, for instance, on the hind end of the body are, according to Greeff's report (Anatomie des Chætoderma nitidulum, Lovén, Zeitschr. f. wiss. Zool., Bd. xxvi. Taf. xiii. figs. 24–26), also flattened, but they are not elliptical in cross-section, like those of *Chætoderma militare*. And again, the spicules on the body of the latter are much less numerous, and we cannot doubt that the examination of fresh or well-preserved specimens of the tropical form would reveal other differences, which, with the material before me, I am unable to detect.

GEOGRAPHICAL DISTRIBUTION.

The following table exhibits the geographical distribution and the occurrence of the species described. I have also noted the localities where those species already known have been previously found.

Species observed in the Challenger and "Porcupine" Expeditions.						Species previously observed.	
Name.	Station.	"Porcupine" Voyage.	Locality.	Depth in Fathoms.	Character of the Bottom.	Depth.	Locality.
Sternaspis princeps, n. sp.	167	...	lat. 37° 34′ S. long. 179° 22′ E.	700	Blue mud.	...	...
Echiurus unicinctus, v. Drasche.	...	...	Japan.	...	...	...	Japan.
Thalassema faex, n. sp.	...	P.	lat. 60° 34′ N. long. 4° 40′ E.	560	...	...	...
Thalassema baronii, Greeff.	...	...	Bahia.	7–20	...	...	...
Bonellia suhmii, n. sp.	47	...	Nova Scotia, lat. 41° 15′ N. long. 65° 45′ W.	1340	Blue mud.	...	...
Phascolosoma vulgare, Blainville.	30	P.	lat. 36° 15′ N. long. 6° 32′ W.	386	...	Near low water mark.	West coast of Europe, Mediterranean, Red Sea.
Phascolosoma vulgare, var. *astuta*, nov.	90	P.	lat. 59° 41′ N. long. 7° 34′ W.	458	...	...	...
Phascolosoma pudicum, n. sp.	...	...	Kerguelen.	10–120	...	...	...
Phascolosoma capense, Teuscher.	...	...	Sea Point, near Cape Town.	Shallow water.	...	...	Cape.
Phascolosoma prioki, Sluiter.	214	...	lat. 4° 33′ N. long. 127° 6′ E.	500	Blue mud.	...	Batavia.
Phascolosoma catharinæ, Fritz Müller.	323	...	lat. 35° 39′ S. long. 50° 47′ W.	1900	...	...	Desterro.
Phascolosoma flagriferum, n. sp.	241	...	lat. 35° 41′ N. long. 137° 42′ E.	2300	...	...	...
	45	...	lat. 37° 25′ N. long. 71° 43′ W.	1700	...	...	...
Dendrostoma blandum, Selenka and de Man.	...	...	Yokohama.	5–25	...	...	Japan.
Phascolion lutense, n. sp.	...	...	lat. 62° 26′ S. long. 95° 44′ E.	1975	Diatom ooze.	...	..
			lat. 53° 55′ S. long. 108° 35′ E.	1950	Diatom ooze.	...	...
Phascolion tubicola, Verrill.	49	...	lat. 4° 21′ S. long. 129° 7′ E.	85	Gravel, stones.	Frequently in deep water.	New England.
Phascolion botulus, n. sp.	195	...	lat. 4° 21′ S. long. 129° 7′ E.	1425	Blue mud.	...	...
Phascolion strombi (Montagu).	...	P.	Killibegs Harbour, Ireland.	...	...	...	North Atlantic.
Phascolion squamatum, Koren and Danielssen.	6 10 36 47	P.	...	358–725	...	100–200	North Sea, Lofoten, &c.
Aspidosiphon speculator, n. sp.	...	...	St. Vincent (Cape Verdes).	Shallow water.	...	...	...
Aspidosiphon truncatus, Keferstein.	201	...	lat. 7° 3′ N. long. 121° 48′ E.	82	Stones, gravel.	...	Panama, Mauritius.
Phymosoma japonicum, Grube.	...	...	Port Jackson.	Shallow water.	...	...	Japan.
Phymosoma scolops, Selenka and de Man.	208	...	lat. 11° 37′ N. long. 123° 32′ E.	18	Blue mud.	...	Philippines, Singapore, Mozambique, Red Sea.
Sipunculus nudus, Linné.	30	P.	lat. 36° 18′ N. long. 6° 52′ W.	386	...	...	Mediterranean, West coast of Europe, West Indies, Philippines.
	22	...	lat. 56° 8′ N. long. 13° 34′ W.	1263	...	...	
Chætoderma militare, n. sp.	210	...	lat. 9° 26′ N. long. 123° 45′ E.	375	Blue mud.	...	...

PLATE I.

PLATE I.

Fig. 1. *Sternaspis princeps*, n. sp.

Three times the natural size; viewed from the ventral aspect.

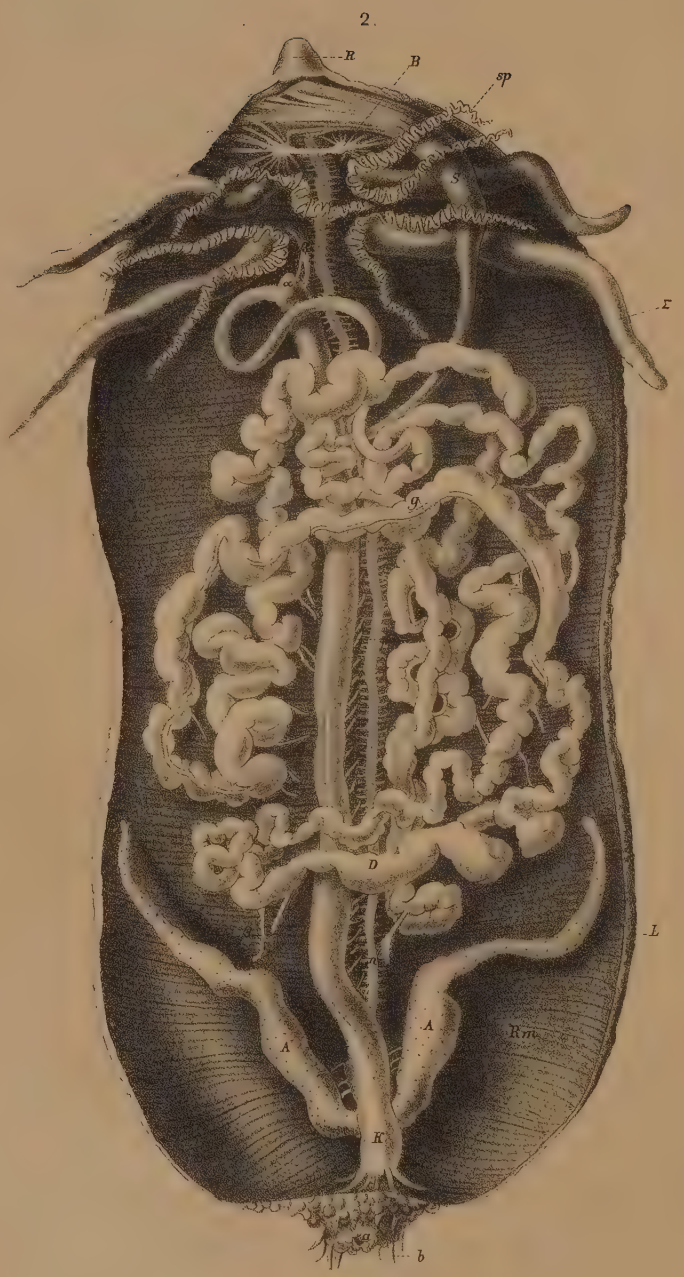
Fig. 2. *Echiurus unicinctus*, von Drasche; $\frac{2}{1}$.

A. Anal vesicles (with ciliated funnels).
a Anal opening.
B. Setæ.
b. The posterior circle of setæ.
β. Fixing muscles of the intestine.
D. Intestinal canal.
α. Diverticulum of the intestine.
g. Blood-vessel accompanying intestine.
K Cloaca.
L. Body-wall.
n. Ventral nerve-cord.
R. Proboscis.
Rm. Circular muscles of the body-wall.
S. Pharynx.
Σ. Segmental organs.
sp. Spiral tubes of the segmental organs.

Fig. 3. *Bonellia suhmii*, n. sp.; natural size.

The figure is copied from the original drawing of Dr. v. Willemoes-Suhm. Both the hind end of the body and the proboscis were torn away.

o. Mouth opening.
v. Opening of uterus.



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1. STERNASPIS PRINCEPS n. sp.
2. ECHIURUS UNICINCTUS v. Drasche 3. BONELLIA SUHMII n. sp.

PLATE II.

PLATE II.

Figs. 4–6. *Bonellia suhmii*, n. sp.

Fig. 4. The internal structure of the very imperfect specimen represented in fig. 3; natural size.

i, *i*. Intestine.
n, *n*. Nerve-cord.
o. Mouth.
ΣΣ. The two anal vesicles.
U. Uterus.
Y. Torn loop of the intestine.

Fig. 5. The uterus, with low power.

T. Ciliated funnel.
m. Efferent aperture.

Fig. 6. The anterior half of an anal vesicle, with medium power.

Figs. 7–10. Male of *Bonellia viridis*, Rol., from Trieste.

Fig. 7. Adult male 1½ mm. long, with high power. The two hooks had fallen off. The nervous system could not be demonstrated.

b. Anterior blind end of the intestine, attached to the parenchymatous tissue by means of contractile muscle-fibres.
b'. Posterior blind end of the intestine, kept *in situ* by means of isolated muscular fibres.
c. Green wandering cells, containing chlorophyll.
d. Connective substance.
e. Ciliated epithelium.
f. Vesicular cells.
g. Generative opening, and near it some expelled spermatozoa.
i. Intestine.
l. Body-cavity.
m. Musculature.
o. Contractile fibres.
p. Nuclei of the peritoneal epithelium.
r. Spermatozoa.
s. The right anal vesicle (Analkieme)—segmental organ.
s'. The left anal vesicle (Analkieme)—segmental organ.
vd. Vas deferens.
y, *y*. External apertures of the segmental organs.
z. Contents of the intestine.

Fig. 8. Cross section in the region A of fig. 7, drawn with the aid of the camera lucida from a chrom-osmic acid preparation.

n. The inferior swelling of the œsophageal ring (the first pair of ventral ganglia).
The other letters are as in fig. 7.

Fig. 9. Cross section in the region B of fig. 7. Letters as above.

Fig. 10. One of the so-called anal vesicles (segmental organs), with very low power. The right is always somewhat smaller, and lies somewhat further back than the left. Each of these segmental organs opens separately to the exterior, ventrally and laterally. By the contractions of the body-wall the blood of the body-cavity and with it the free funnels of the segmental organs are driven backwards and forwards. The rim of the funnel is formed of from five to seven ciliated cells. The lumen of the segmental duct is ciliated, but only interruptedly, not continuously.

v. Wall.
u. Lumen with lash-like cilia.
x. Funnel opening.
z. Exterior opening.

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4-6. BONELLIA SUHMII, n. sp.
7-10. BONELLIA VIRIDIS, Rol. mas.

PLATE III.

PLATE III.

Figs. 11, 12. *Echiurus unicinctus*, von Drasche.

Fig. 11. The large terminal funnels from the anal vesicles; × 900. The pointed flagellate cells of the funnel margin are figured from a fresh specimen of *Echiurus pallasii*.

a. The flagellate cells forming the rim of the funnel.
p. Nuclei of the peritoneum.
i. The internal wall of the funnel.
k. Communication between the canal of the funnel and the lumen of the anal vesicle.
m. Branched contractile cells occupying the interspace between the inner and outer walls of the funnel.

Fig. 12. A smaller lateral funnel. Letters as in fig. 11.

Fig. 13. *Thalassema faex*, n. sp.

Fig. 13. One of the two anal vesicles; magnified 8 times.

r. Opening into the cloaca.

Figs. 14–16. *Phascolosoma pudicum*, n. sp.

Fig. 14. Hooks of the proboscis arranged in a ring; × 140.

Figs. 15, 16. Papillæ from the surface of the body; × 350.

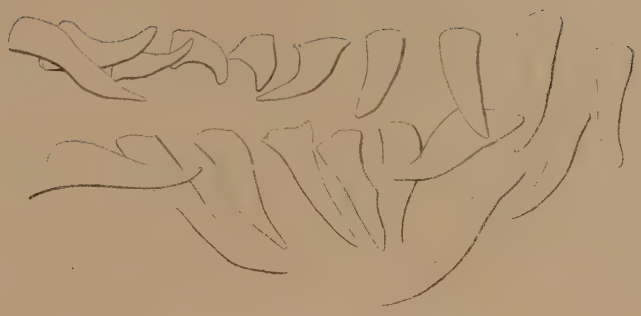
Fig. 17. *Phascolosoma flagriferum*, n. sp.

Fig. 17. The animal drawn natural size.

a. Anus.

12.

14.



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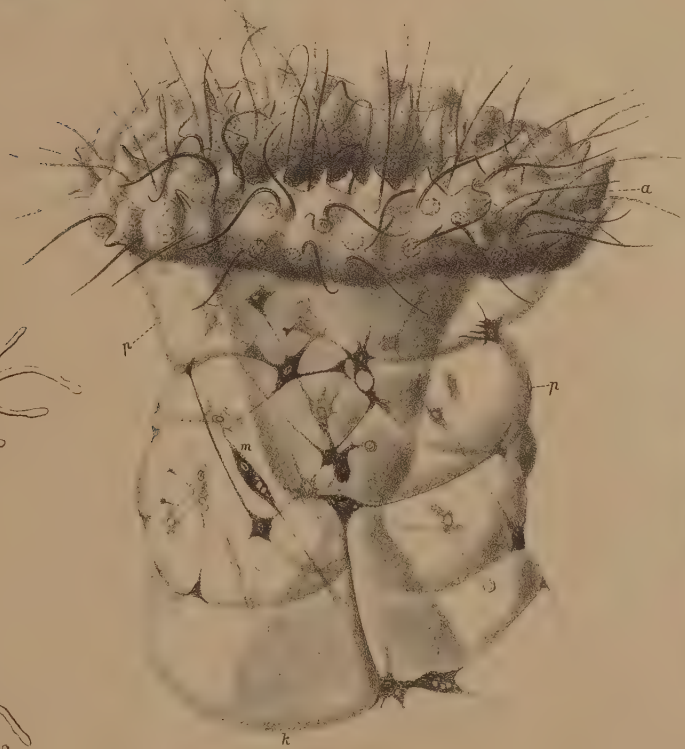

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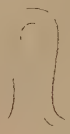
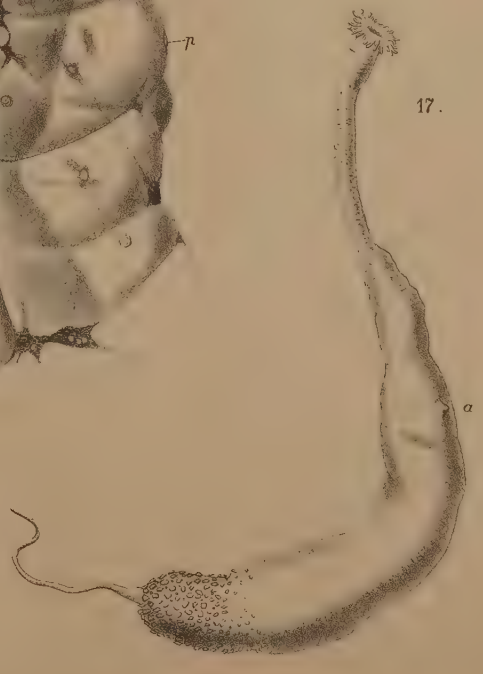


13.

17.



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11-12. ECHIURUS UNICINCTUS, v. Drasche. 13. THALASSEMA FAEX, n. sp.
14-16. PHASCOLOSOMA PUDICUM, n. sp. 17. PHASCOLOSOMA FLAGRIFERUM, n. sp.

PLATE IV.

PLATE IV.

Figs. 18, 19. *Phascolion squamatum*, Koren and Danielssen.

Fig. 18. The animal magnified 5 times.

Fig. 19. Scales from the surface of the body, seen with low power.

a. A papilla from the proboscis, under high power.

Fig. 20. *Phascolion botulus*, n. sp.

Fig. 20. Hooked papilla; magnified 160 times.

Fig. 21. *Phascolion strombi* (Montagu).

Fig. 21. Specimen from Killibegs Harbour, Ireland; magnified 4 times.

Figs. 22, 23. *Phascolion lutense*, n. sp.

Fig. 22. The animal magnified thrice. On the proboscis the cutaneous glands are visible.

Fig. 23. Two adjacent glands with papillæ round their openings, from the hind end of the body; magnified 200 times.

Figs. 24–27. *Aspidosiphon speculator*, n. sp.

Fig. 24. The internal structure; magnified 5 times.

A. The rough anal shield.
a. Anus.
D. Intestinal spiral.
H. End of proboscis (not stretched out to its full length).
n. Ventral nerve-cord.
R. Proboscis.
Rm. Retractor of the proboscis.
ΣΣ'. Segmental organs.
S. The caudal shield with its radiating grooves.

Fig. 25. Hooks on the anterior portion of the proboscis; $\frac{750}{1}$

Fig. 26. Hooks from the posterior portion of the proboscis; $\frac{750}{1}$.

Fig. 26*b*. Bodies round the opening of the proboscis; $\frac{750}{1}$.

Fig. 27. Cutaneous glands, with supporting chitinous plates, viewed from above; $\frac{600}{1}$.

Figs. 28–32. *Chætoderma militare*, n. sp.

Fig. 28. Calcareous spicule, viewed from above and in cross section; $\frac{500}{1}$.

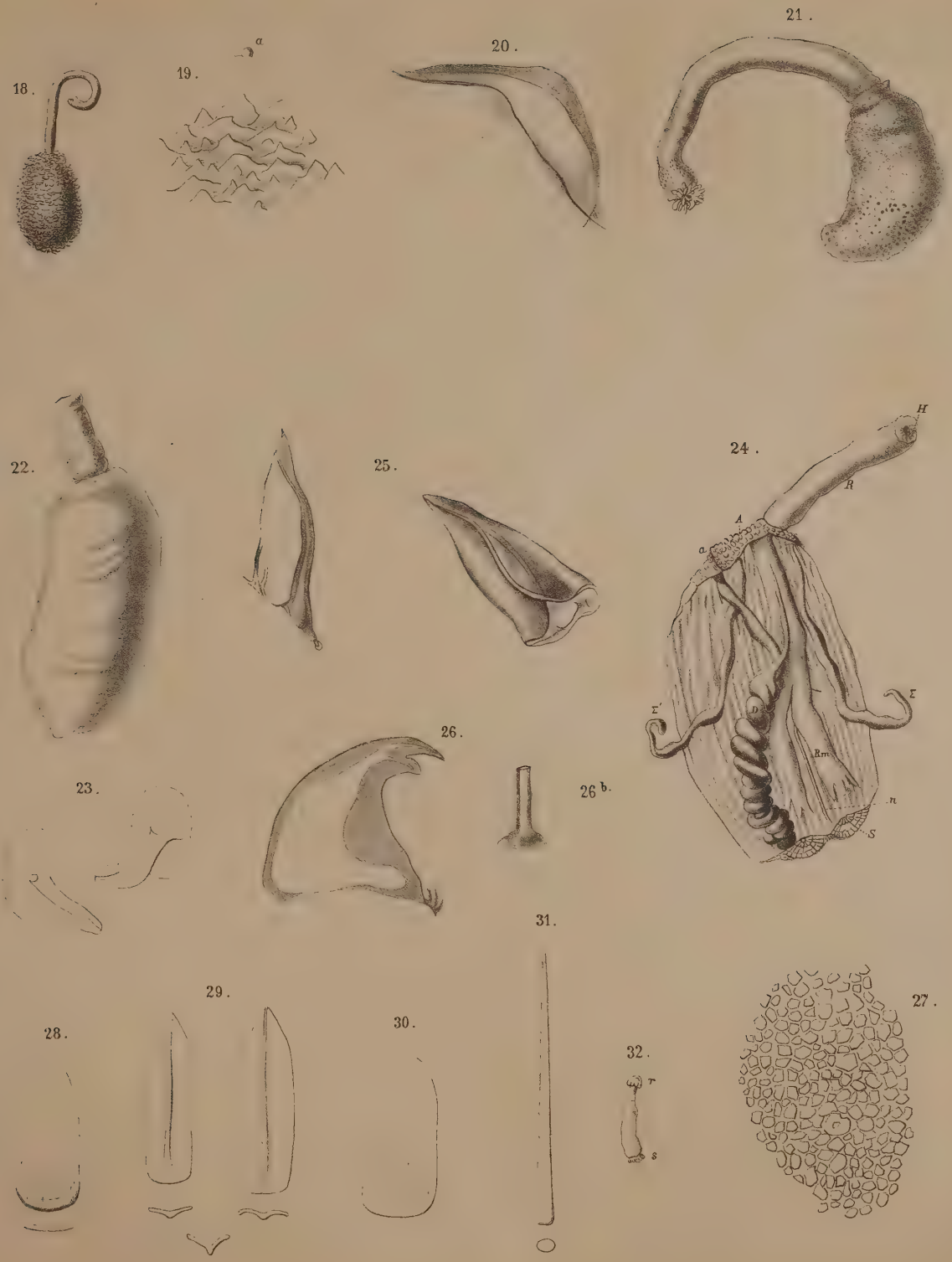
Fig. 29. Calcareous spicules from the median portion of the proboscis, viewed from above and in cross section; $\frac{500}{1}$.

Fig. 30. Prickle from the posterior portion of the proboscis and from the body; magnified 160 times.

Fig. 31. Prickle of the posterior portion of the body, from the side and in cross section.

Fig. 32. The whole animal in its natural size.

r. Proboscidal portion. | *s.* Caudal portion.



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18-19. PHASCOLION SQUAMATUM, KOREN & DAN. 20. PHASCOLION BOTULUS, n. sp.
21. PHASCOLION STROMBI, MONT. 22-23. PHASCOLION LUTENSE, n. sp.
24-27. ASPIDOSIPHON SPECULATOR, n. sp. 28-32. CHAETODERMA MILITARE, n. sp.

The Zoology of the Voyage of H.M.S. Challenger.

PART XXXVI.

REPORT ON THE GEPHYREA.

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